Final Report

International Conference on
"Dynamics of Disordered Materials on the Nanometer Scale"
Hanoi, Vietnam
February 22-27, 2004

This aim of this conference was to promote the confluence of ideas and expertise from diverse experimental and theoretical approaches in order to accelerate research on the dynamics of disordered materials on the nanometer scale. The meeting brought together experimentalists and theorists from the physical and biological sciences and engineering with expertise in synthesis and characterization of materials as well as in their theoretical modeling and computer simulations. Diverse aspects of the dynamics of disordered systems were covered including systems both in and out of thermodynamic equilibrium.

The bulk of our world is made up of disordered materials, many of which are not in thermodynamic equilibrium. The microscopic dynamics of these disordered systems, down to the space-time scale of nanometer and nanosecond, provides a basis for the understanding of many phenomena in nature. In crystalline solids, by virtue of the long-range translational symmetry of the position and orientation of atoms and molecules, the detailed structure and dynamics can be studied with the fine art of crystallography and solid-state spectroscopies. However, in the case of disordered systems, interpretation of diffraction and spectroscopic data is complex, often invoking statistically averaged expressions of the underlying short-to-intermediate range order structure. As a result, the microscopic properties, especially those involving dynamic fluctuations about the local configurational minima, are less understood.

In the last few years, an emerging theme of considerable interest is the dynamics of fluids in confined geometry and on reduced length scales in the nanometer range. Driven in part by its obvious relevance to biology, the greatest body of work has been on "interfacial water", a term which includes water in porous media such as Vycor and mesoporous materials, in the interior of biological cells or on the surfaces of proteins and lipid bilayers. Other relevant areas include liquids (e.g., helium and organic fluids), and metals and semiconductors confined in micro- and mesophase environments (e.g., zeolite supercages). Features affected by confinement include melting-point depression, hysteresis between freezing and melting, modifications to bulk solid structure and solid-solid transitions.

The organizers of this conference believed that it was timely to address the issue of dynamics of confined disordered materials in an international forum. The goal was to bring together about 60 scientists from the physical and biological sciences and engineering to discuss this topic and exchange recent results and new ideas. The conference format included keynote and invited talks, featured oral presentations and a poster session.

The meeting was efficiently organized by Engineering Conferences International (ECI), Brooklyn, New York, USA, in cooperation with the Institute of Physics of the National Center for Science and Technology (NCST), Hanoi.

The conference co-chairs were the following:

David L. Price, CNRS-CRMHT, France
Rajiv Kalia, University of Southern California, USA
Masatoshi Arai, KEK, Japan
Chun-Keung Loong, Argonne National Laboratory, USA

The scientific program was set by the co-chairs with input from the International Advisory Committee, consisting of:

Nghi Q. Lam, Editor, Applied Physics Letters, Argonne, IL, USA (Chair)
Yasuhiko Ito, Kyoto University, Japan
Shuit-Tong Lee, City University of Hong Kong, Hong Kong SAR, China
Vincent McKoy, California Institute of Technology, Pasadena, CA, USA
V. Lien Nguyen, Institute of Physics, Hanoi, Vietnam
Michel Rosso, PMC, Ecole Polytechnique, Palaiseau, France
Mark Sansom, Oxford University, UK
Fumiko Yonesawa, Keio University, Yokohama, Japan

Financial support was provided by the Asian Office of Aerospace Research and Development of the US Air Force Office of Scientific Research, by the International Relations and Physical and Mathematical Sciences Departments of the Centre National de la Recherche Scientifique (CNRS), France, and by ECI.

The conference venue was the Daewoo Hotel, a luxury hotel on the outskirts of Hanoi, where the overseas participants were accommodated. The administrative and financial arrangements for the meeting were handled by ECI, while the social events and transportation were graciously arranged by the Local Organizing Committee, consisting of:

A. Viet Nguyen, Director, Institute of Physics, NCST, Hanoi (Chair)
V. Lien Nguyen, Institute of Physics, NCST, Hanoi
T. Cong Bach, Hanoi University of Natural Sciences
H. Quang Nguyen, Institute of Physics, NCST, Hanoi
X. Hoang Trinh, Institute of Physics, NCST, Hanoi.

There were 64 registered participants, including 22 from Vietnam, 15 from the US, 8 each from France and Japan and the remainder from Australia, Canada, China, Germany, Israel, Italy, the Netherlands and Thailand. The full list of participants is attached. The program allowed for ample time for discussion after each talk and during the coffee and lunch breaks and the early afternoons. A small poster session was held Tuesday afternoon, and a cultural and historical tour of Hanoi during Wednesday afternoon.

An important aspect of the meeting was to foster new contacts and develop existing contacts between scientists from Vietnam and other countries. A special seminar was held on the Monday after the conference to develop scientific awareness, collaboration and future exchanges between Vietnam and the United States.

The conference was inaugurated by a ceremonial session in which the participants were welcomed by Professor Dang Vu Minh, Director-General of the NCST. M. Bruno Paing, Attaché for Cooperation in Science and Technology in the French Embassy, and Mr. Gary Sigmon, Science and Technology Officer in the US Embassy, joined in the welcome and provided brief descriptions of their countries' involvement in scientific and cultural exchanges with Vietnam.

The scientific activity of the conference consisted of eight sessions, each addressing a particular aspect of the dynamics of disordered materials on the nanoscale:

I: Organization of Biological Systems
II: Dynamics of Nanoconfined Fluids
III: Confinement Effects in Electrolytes
IV: Biomolecular Dynamics
V: Nanoclusters and Granular Materials
VI: Nanostructured Materials
VII: Dynamical Heterogeneity in Disordered Systems
VIII: Properties and Nanostructures of Glassy Materials

The names of the speakers in each session and the titles of their talks are listed in the attached program. As expected, there were recurring themes with considerable overlap between the different topics. This resulted in lively discussions after almost every talk, which generally had to be curtailed by the session chair.

In responses to a questionnaire circulated at the end of the meeting, all conferees indicated that they found the meeting informative and stimulating. The graciousness of the Vietnamese hosts and the fascinating culture and history of the country contributed to a memorable experience for the overseas participants.

There was unanimous support for a proposal to hold a similar conference in the same or a closely related topic in two to three years time, perhaps at another location in South-East Asia.

PROGRAM

Sunday, February 22, 2004

6:00 pm – 8:00 pm	Registration
8:00 pm – 8:30 pm	Welcome mixer
	Introductory Remarks Jules Routbort, ECI David L. Price, CRMHT-CNRS
8:30 pm	Buffet Dinner

Monday, February 23, 2004

8:00 am – 9:00 am	Breakfast
9:00 am – 9:30 am	**Ceremonial Session** Chair: David L. Price, CRMHT-CNRS, France
	Professor Dang Vu Minh Director-General, National Center for Natural Science and Technology of Vietnam
	M. Bruno Paing Attaché for Cooperation in Scien
	Mr. Gary Sigmon Science and Technology Officer Embassy of the United States of America to Vietnam
9:30 am	**Session I: Organization of Biological Systems** Chair: Rajiv Kalia, University of Southern California, USA
9:30 am – 10:30 am	**Keynote Lecture** *Complex conformational dynamics of native proteins* Nobuhiro Go, Japan Atomic Energy Research Institute
10:30 am – 10:55 am	*The critical role fibronectin and its cellular integrin receptor play in macrophage differentiation* Eliezer Huberman, Argonne National Laboratory, USA
10:55 am – 11:30 am	Coffee Break
11:30 am – 12:20 pm	**Invited Talk** *Dense phases of DNA and nucleosomes* Francoise Livolant, Laboratoire de Physique des Solides, France

12:20 pm – 12:45 pm	*Protein folds in a pre-sculpted free energy landscape* Trinh Xuan Hoang, Institute of Physics, Vietnam
1:00 pm – 2:00 pm	Buffet Lunch
2:00 pm – 4:30 pm	*ad hoc* discussions / Free time
4:30 pm	**Session II: Dynamics of Nanoconfined Fluids** Chair: A. Viet Nguyen, Institute of Physics, Vietnam
4:30 pm – 5:20 pm	**Invited Talk** *Quasielastic neutron scattering investigation of the translational and rotational dynamics of supercooled water confined in nanoporous silica matrices* Sow-Hsin Chen, Massachusetts Institute of Technology, USA
5:20 – 5:45 pm	*Anomalously soft dynamics in nanotube-water: Relevance to water/proton transport across biological membranes* Alexander Kolesnikov and Chun-Keung. Loong, Argonne National Laboratory, USA
5:45 pm – 6:15 pm	Coffee Break
6:15 pm – 7:05 pm	**Invited Talk** *Excitations, Bose-Einstein condensation and superfluidity in quantum liquids in disorder* Henry R. Glyde, University of Delaware, USA
7:05 pm – 7:30 pm	*Critical behavior of fluid binary mixtures confined in Vycor porous glass* Ferdinando Formisano, INFM, Grenoble, France
8:00 pm	Buffet Dinner

Tuesday, February 24

8:00 am – 9:00 am	Breakfast
9:00 am	**Session III: Confinement Effects in Electrolytes** Chair: Masatoshi Arai, KEK, Japan
9:00 am – 9:50 am	**Invited Talk** *Structure-determined dynamics in supercooled liquids* Peter Harrowell, University of Sydney, Australia
9:50 am – 10:15 am	*Dynamics in inoomer membranes for fuel cells* Sandrine Lyonnard, CEA Grenoble, France

10:15 am – 10:40 am	*Effect of nanoscopic confinement on the dynamics of glass-forming liquids and polymers* Reiner Zorn, Forschungszentrum Juelich, Germany
10:40 am – 11:10 am	Coffee Break
11:10 am – 12:00 pm	**Invited Talk** *Ion transport in polymer and plastic materials* Douglas R. MacFarlane, Monash University, Australia
12:00 pm – 12:25 pm	*Do nanoparticles reduce ion-pairing in polymer electrolytes?* Gordon J. Kearley, IRI, TU-Delft, The Netherlands
1:00 pm – 2:00 pm	Lunch
2:30 pm – 4:30 pm	**Poster Session**
4:30 pm	**Session IV: Biomolecular Dynamics** Chair: Chun-Keung Loong, Argonne National Laboratory, USA
4:30 pm – 5:30 pm	**Keynote Lecture** *Hybrid multiscale simulations on parallel distributed computers* Rajiv Kalia, University of Southern California, USA
5:30 pm – 5:55 pm	*Temperature- and pressure-dependences of a bending modulus of surfactant monolayers in a ternary microemulsion composed of AOT / D_2O / decane* Hideki Seto, Kyoto University, Japan
5:55 pm – 6:25 pm	Coffee Break
6:25 pm – 7:15 pm	**Invited Talk** *Biomolecular dynamics: water-macromolecule interactions* Antonio Deriu, University of Parma, Italy
7:15 pm – 7:40 pm	*Interplay between slow interfacial water diffusion and colloid dynamics: a way to probe colloidal transitions* Pierre Levitz, CNRS - Ecole Polytechnique, Palaiseau, France
8:00 pm	Cultural Dinner with Cruise, Ho Tay Lake

Wednesday, February 25

8:00 am – 9:00 am	Breakfast
9:00 am	**Session V: Nanoclusters and Granular Materials** Chair: Pierre Levitz, CNRS - Ecole Polytechnique, France
9:00 am – 10:00 am	**Keynote Lecture** *Numerical computations of granularity: a school for theory and theorists* Leo P. Kadanoff, University of Chicago, USA
10:00 am – 10:25 am	*Toward first principles prediction on the nanoscale* J. Woods Halley, University of Minnesota, USA
10:25 am – 10:50 am	*Structuring carbon forms by energetic species: Amorphous, nanotubes and crystalline* Yeshayahu Lifshitz, City University Hong Kong
10:50 am – 11:20 am	Coffee Break
11:20 am – 12:10 pm	**Invited Talk** *Confinement of narrow-gap semiconductors* Marie-Louise Saboungi, CRMD - CNRS, France
12:10 pm – 12:35 pm	*Direct observation and computer simulation of spatio-temporal nanostructural fluctuations in amorphized intermetallic compounds* Seiichi Watanabe, Hokkaido University, Japan
12:35 pm – 1:00 pm	*Synthesis, characterization and application of disorder and nano-structured molecular sieves* Vu Anh Tuan, Institute of Chemistry, NCST, Vietnam
1:00 pm – 1:45 pm	Lunch
2:00 pm	Hanoi City Excursion
8:00 pm	Traditional Dinner, Dinh Lang Restaurant

Thursday, February 26

8:00 am – 9:00 am	Breakfast
9:00 am	**Session VI: Nanostructured Materials** Chair: Michel Rosso, LPMC - Ecole Polytechnique, France
9:00 am – 10:00 am	**Keynote Lecture** *Fabrication of metal nanoparticles by relaxative auto dispersion (RAD) process* Shigehito Deki, Kobe University, Japan
10:00 am – 10:50 am	**Invited talk** *Dipole-exchange theories of spin waves in ferromagnetic nanostructures* M.G. Cottam, University of Western Ontario, Canada
10:50 am – 11:20 am	Coffee Break
11:20 am – 12:10 pm	**Invited Talk** *Nanostructured polymeric glasses* Luigi Cristofolini, University of Parma, Italy
12:10 am – 12:35 am	*Semiconducting nanowires - from synthesis to applications* Shuit-Tong Lee, COSDAF, City University of Hong Kong
12:35 pm – 1:00 pm	*Kinetic 'crushing' mechanism for enhancing two-dimensional ordering of nanocrystal superlattices* T. T. Nguyen, The James Frank Institute, University of Chicago, USA
1:00 pm – 2:00 pm	Lunch
2:00 pm – 4:30 pm	*ad hoc* discussions / Free time
4:30 pm	**Session VII: Dynamical Heterogeneity in Disordered Systems** Chair: Shuit-Tong Lee, COSDAF, City University of Hong Kong
4:30 pm – 5:20 pm	**Invited Talk** *The dual challenge: Inducing and understanding ion motion in solids* Michel Armand, Laboratoire International CNRS, Canada
5:20 pm – 5:45 pm	*Path integrated approach to a single polymer chain with random medium* Viruth Sayakanit, Bangkok, Thailand
5:45 pm – 6:10 pm	Coffee Break

6:10 pm – 6:25 pm	*Pulsed neutron sources* Masatoshi Arai, KEK, Japan
6:25 pm – 6:40 pm	*Synchrotron x-ray sources* James Viccaro, University of Chicago, USA
7:00 pm	Conference Banquet hosted by the Institute of Physics, Hanoi

Friday, February 27

8:00 am – 9:00 am	Breakfast
9:00 am	**Session VIII: Properties and Nanostructures of Glassy Materials** Chair: Nghi Q. Lam, Applied Physics Letters, USA
9:00 am – 9:50 am	**Invited Talk** *Nanoscale damage and crack propagation in glassy materials* Elisabeth Bouchaud, CEA-Saclay, France
9:50 am – 10:15 am	*Radiation-induced, order-disorder transformations in pyrochlore* Rodney C. Ewing, University of Michigan, USA
10:15 am – 10:45 am	Coffee Break
10:45 am – 11:35 am	**Invited Talk** *Crystal-to-amorphous solid state structure transitions in metallic alloys* Kenji Suzuki, Advanced Institute of Materials Science, Japan
11:35 am – 12:00 pm	*Atomic configurations in the structure of metallic glasses* Daniel B. Miracle, Materials and Manufacturing Directorate, USA
	Conference close

Saturday, February 28 - Sunday, February 29

Ha Long Bay Excursion (see photograph on last page)

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Some of the participants enjoying the unique scenery at Halong Bay during the post-conference excursion